Management of Common Psittacine Reproductive Disorders in Clinical Practice

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KEYWORDS

• Chronic egg laying • Dystocia • Prognosis • Psittacine

The reproductive organs play a key role in the maintenance of normal homeostasis in psittacine birds. For this reason, sex determination should be part of the baseline data collected on every avian patient. Disorders of the psittacine reproductive tract can have a negative effect on the function of other organ systems in the body. Reproductive organs may be plagued by a multitude of problems ranging from infection and neoplasia to inflammation and idiopathic issues that affect fertility. Detection of reproductive problems may require the use of a variety of modalities. The ability to treat these problems often depends on the presenting complaint as well as the clinical condition of the avian patient. Improvement in detection and treatment of reproductive conditions will occur as new information is presented through publication of research and clinical cases.

REVIEW OF FEMALE REPRODUCTIVE ANATOMY

The reproductive tract of all psittacine birds is present only on the left side of the bird. During embryonic growth of the female, a right gonad does exist for a brief period before its development is arrested. From this point on, the left-sided organs become the dominant reproductive organs.

From the cranial to the caudal aspect, the reproductive tract of the mature hen consists of the follicle-containing ovary, an infundibulum, the magnum, the isthmus, the uterus (also known as the shell gland), and the vagina. The size of the follicles in the breeding hen tends to vary from small to very large, giving the appearance of a large cluster of grapes. At this stage of development, the follicles may occupy a larger part of the cranial aspect of the reproductive tract. In the mature, nonbreeding hen or

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the immature hen, the follicles are regressed in appearance and tend to be tiny to small in size.

The infundibulum, which represents the first part of the left oviduct, serves a key function that requires successful capture of the oocyte in its funnel-like cup. The second part or tubular region of the infundibulum is the likely site for fertilization of the oocyte by the spermatozoon.

The magnum with its thick mucosal folds and coiled regions follows the infundibulum. After the magnum, a short isthmus is followed by the uterus. In general, it may be difficult to grossly distinguish the boundaries between the magnum, the isthmus, and the uterus. The uterus is the primary site for formation of the shell of the egg. It is also the primary place in the oviduct where the egg spends most of its time during formation.

A vaginal sphincter abruptly marks the junction between the caudal aspect of the uterus and the cranial aspect of the vagina. The sphincter area of the vagina is where the storage of spermatozoa occurs. The main compartment of the vagina is characterized by a thick muscular wall. In general, it takes an egg about 25 hours to pass down the entire extent of the oviduct.[1,2]

FEMALE REPRODUCTIVE DISORDERS

Polyostotic Hyperostosis

Polyostotic hyperostosis is a normal physiologic process in which calcium is deposited into the nonpneumatic long bones of hens before the beginning of egg laying. Radiographically, this condition may be seen as increased calcium deposition in the bones of the radius, ulna, femur, tibiotarsus, or vertebrae.[3] A similar pathologic condition called osteomyelosclerosis may be seen in hens with disease of the reproductive tract, such as ovarian cysts or egg yolk peritonitis, or in males with gonadal tumors.[4] The cause of both these processes has not been fully determined, but reproductive hormones such as estrogen or testosterone are thought to play a role. The pathologic lesions associated with osteomyelosclerosis usually resolve with resolution of the disease process.[5,6]

Chronic Egg Production

Chronic egg laying is another common disorder seen in female birds. Species that tend to be overrepresented as chronic egg layers include parakeets (*Melopsittacus undulatus*), cockatiels (*Nymphicus hollandicus*), and lovebirds (*Agapornis* spp). In captivity, most normal egg layers lay no more than 2 to 3 clutches per year. A bird that lays eggs chronically may have multiple clutches per year—some as frequently as once monthly or every 2 months. Other chronic layers may lay more than the average 2 to 4 eggs per clutch. The cause of this condition may differ among individual birds. Suspected causes include increased photoperiod, increased temperature, bonding with a bird of either sex, bonding with a favorite toy, providing substrate in the cage that resembles nesting materials, or potentially abnormal bonding with the owner.[7,8]

One of the main risks of overproduction of egg in these birds is the potential to deplete calcium stores necessary to form a proper egg.[9] Initially, birds may lay calcified eggs, but as calcium stores decrease, the eggs produced may become thin or soft shelled. These birds are also susceptible to depletion of energy stores because of the constant egg laying and pathologic fractures. Such birds are the classic future candidates for dystocia. Management of these birds may include nutritional adjustment, such as oral calcium supplementation, and minimizing exposure to some of the potential environmental causes previously described.[7,8]

When these methods fail to control chronic egg laying, some birds may respond to hormone therapy. Leuprolide acetate, the superactive gonadotropin-releasing hormone agonist, has been used in these patients to attempt to control present or future episodes of egg overproduction.[10] In a crisis situation, a dose of leuprolide acetate of up to 800 μg/kg intramuscularly (IM) every 14 days for 3 doses followed by monthly maintenance of up to 800 μg/kg IM every 21 to 30 days has been successfully used in some patients by Mitchell.[10] However, the dose and frequency of doses needed to control ovulation varies between individual birds and should be considered on a case-by-case basis.[11] Some birds may need hormone therapy only at certain times of the year, whereas others may need it monthly throughout the year. In general, the prognosis for control of chronic egg laying is guarded to fair in these birds.

Birds in which chronic egg production cannot be adequately controlled may be candidates for surgery. A salpingohysterectomy is performed in chronic egg layers to prevent recurrence.[7,12–14] The inability to remove the left ovary may create a small risk, in that some birds may continue to be reproductively active and potentially ovulate into the coelomic cavity.

Dystocia

Dystocia, or delayed oviposition, is one of the most common female reproductive disorders seen in clinical practice. In psittacine birds, the normal length of time for egg production and the delivery of an egg through the reproductive tract as well as the total number of eggs produced in a clutch are dependent on the species of the bird. These reproductive functions represent dynamic processes that are also affected by influences such as health status, temperature, presence or absence of a mate, hormones, photoperiod, season of the year, nutrition, and other related environmental stressors that captivity may bring. Eutocia occurs when all of these influences come together to create normal delivery of an egg without a negative effect on the hen. Under circumstances of dystocia, there is some interference with the hen's ability to undergo a normal egg delivery. Abnormal egg delivery may also result from or be a cause of concurrent health issues in the hen.

Dystocia clinical signs

Clinical symptoms of dystocia in a hen include fluffed feathers that give the bird a puffy appearance, open-mouth breathing, decreased to scant to absent droppings, watery droppings that contain little or no feces, and a coelomic cavity enlarged with fluid or of a firm circular structure.[15] Other signs include weakness or paresis of the left leg, a decreased appetite that may progress to anorexia, regurgitation, vomiting, and straining to defecate or pass an egg. Decreased function of the left leg may be a direct result of egg pressure on the nearby left sciatic nerve. Prolapse of the cloaca or oviduct, which has a cobblestone appearance to the mucosa, is also commonly seen. Avian species commonly seen in dystocia include budgerigars (*M undulatus*), lovebirds (*Agapornis* spp), cockatiels (*N hollandicus*), cockatoos (*Cacatua* spp), and Amazon parrots (*Amazona* spp).[16]

A bird in dystocia may appear completely normal at the onset of this syndrome. In some of these birds, the only clinical signs may be that the egg can be palpated by the owner for more than 24 hours and mild straining. For this reason, it is vital to obtain a complete and thorough history from the owner to aid in appropriate assessment of the bird's condition. Other birds in dystocia may run the gamut of health from mild to moderate to severe illness characterized by a combination of the clinical symptoms previously described. Severely ill birds tend to be extremely lethargic and stay only in the bottom of the cage. These birds may have difficulty breathing and may

also be exhausted from occasional attempts to push the egg out of their bodies. Some of these birds exhibit continual winking of the vent, which is an outward sign that lower coelomic muscles are constantly working to push out an egg.

Diagnosis, assessment, and therapy of dystocia

Initial assessment of the clinical condition of a hen in dystocia is the key to determining the prognosis as well as the best initial treatment needed to stabilize the bird. Assessment of preliminary blood work, such as a complete blood count and chemistry profile, may provide information on kidney function, total white cell count, and differential white cell count. A cloacal culture and sensitivity may be needed to rule out the presence of infection. Direct palpation may reveal an egg that is located very high in the coelomic cavity or just cranial to the pelvis. In a more distally located egg, slight manipulation of the external skin of the vent during the physical examination may reveal the egg's chalky white shell.

If more certainty regarding the location of the egg is needed, a radiograph may be the most logical next step. A ventrodorsal or standing radiograph may provide more specific information about egg location than just palpation alone. Whether or not sedation is used should be based on the general condition of the patient. Some very critical hens may not survive sedation in part due to renal shock caused by direct pressure of the egg on the left kidney. Palpation or radiography may reveal an egg of either normal diameter or overlarge diameter that is too big to fit across the pelvic canal.

A mildly ill hen in dystocia for 24 hours or less may initially require parenteral fluid therapy (100–125 mL/kg/d of a balanced electrolyte solution divided into twice or thrice daily treatments), application of a water-based lubricant to the inside of the vent area and possibly surrounding the egg itself, a warm incubator heated up to 85°F to 90°F, and parenteral calcium therapy (100 mg/kg IM once). In many situations, this minimal treatment may be all that is needed to help the bird facilitate the passage of the egg. The prognoses in these cases tend to be fair to good.

Use of a broad-spectrum antibiotic medication at this stage may not be required and is at the discretion of the clinician. Possible pain and inflammation associated with dystocia may be relieved with an antiinflammatory medication such as meloxicam, 0.1 to 1.0 mg/kg. An opioid medication such as butorphanol (1–4 mg/kg IM) may also help ease pain.[11] In cases of suspected renal compromise, care should be taken to avoid high doses of nonsteroidal antiinflammatory medications. Leuprolide acetate (800 μg/kg IM) or the luteinizing hormone activity of chorionic gonadotropin have also been used in an attempt to prevent further egg laying in the near future; however, this may not prevent oviposition in the current clutch.[17] Published or commonly used doses of these and other medications are available.[11]

Oxytocin (5–10 IU/kg IM) or prostaglandin $F_{2\alpha}$ (0.02–0.1 mg/kg IM) may also be used to facilitate egg laying. Use of either drug is contraindicated if the vaginal sphincter is constricted or if uterine adhesions exist. A prostaglandin E_2 gel (0.02–0.1 mg/kg applied topically) may induce relaxation of the vaginal sphincter. Parenteral calcium administration should also precede oxytocin use.[11]

More immediate and invasive initial steps may be needed for a bird that is moderately to severely ill. The birds that fall in this category have usually been trying to pass an egg for more than 24 to 48 hours. These birds may be extremely critical metabolically, and actions should be taken to immediately relieve the pressure created by the egg on their left kidney as well as their left sciatic nerve. That is why it is vital to obtain as thorough a history as possible. Some of the initial treatment may resemble what was previously described for mildly affected birds.

These critical birds may also require invasive methods to deflate or remove the egg. One common procedure performed involves aspiration of the egg. A 20- or 22-gauge needle attached to a 12-mL or 20-mL syringe is directly inserted into the egg via a vent approach, if the egg can be grossly visualized or via a transcutaneous approach, if the egg is located higher in the coelomic cavity. Care must be taken to insert the needle cleanly so that a good seal is created between the egg and the needle. When the needle bevel is near the center of the egg the contents may be aspirated. Aspiration should enable collapse of the egg and facilitate easy exit from the coelomic cavity as long as no adhesions already exist between the egg and the oviduct. Sedation of birds for this procedure, particularly to minimize pain and movement, is recommended, except in critically ill birds for which anesthesia is precluded. In either situation, use of parenteral antiinflammatory and analgesic medications helps mediate any discomfort. The collapsed egg may be manually removed from the vent or is usually found in the droppings within 1 to 2 days postcollapse (**Fig. 1**).

Another possible complication in hens with delayed oviposition is that a second or third egg may start to work its way down the oviduct before the original problematic egg is removed. This complication usually occurs when adhesions have formed between the original egg and the oviduct (**Fig. 2**). In most cases, surgery is needed to remove the eggs from the oviduct. If the oviductal tissue damage is severe and the tissue cannot be saved, a salpingohysterectomy may be performed.[12] A procedure for minimally invasive endoscopic surgery has been developed in birds.[13,14] The tissue removed during this procedure should be submitted for histopathology to aid with diagnosis and to rule out neoplasia. The prognosis for complete recovery in critical birds is guarded. Assessment of other complicating factors, such as cloacal prolapse, is warranted to determine whether additional treatments are needed. Many other clinical symptoms seen early in the course of assessment, such as difficulty breathing and weakness of the hind limbs, may resolve over time with resolution of the dystocia.

Soft- or thin-shelled eggs may be palpated but not always easily visualized radiographically. These eggs are more likely to form when the bird's calcium stores have become depleted due to chronic egg laying and poor calcium content in the diet or when the eggs are unable to reach the uterus for calcium deposition due to a blockage near the uterus. Such eggs may also play a role in dystocia, if they are too large or form adhesions with the oviduct. Rupture of eggs may occur because of rough handling of the bird, when an egg has been in the oviduct too long and starts to break down, or secondary to straining on the part of the bird to pass the egg. Ruptured eggs with secondary oviductal adhesions or related infection carry a guarded to poor prognosis for survival.

Fig. 1. Part of collapsed egg of parrot. (*Courtesy of* Dr Kemba Marshall, DVM, Phoenix, AZ, USA.)

Fig. 2. Surgically removed parrot egg with evidence of adhesions. (*Courtesy of* Dr Kemba Marshall, DVM, Phoenix, AZ, USA.)

Oviductal Prolapse

Prolapse of the left oviduct may occur under several scenarios. It may occur as part of normal egg laying or as part of a disease process in which the differentials include infection or inflammation of the oviductal tissue, neoplasia, or behavioral causes.[7] Dystocia is one of the most common causes of oviductal prolapse. Inflammation, irritation, and eventual prolapse are likely sequelae when a bird struggles to pass an egg. Many birds are exhausted by the time a prolapse has occurred. Both infection and inflammation secondary to uterine adhesions from ruptured eggs may occur. A complete blood count, chemistry profile, whole body radiography, cloacal endoscopy, and culture and sensitivity of the prolapsed tissue may be obtained for a more thorough patient evaluation.

A prolapse of the oviduct may be grossly distinguishable from a cloacal prolapse by the corrugated or cobblestone appearance of the oviductal mucosa. The prolapse may be resolved by successfully treating the inciting cause. Prolapsed tissue should be addressed immediately to prevent dessication. Topical water-based lubricants may be applied to the tissue until medical intervention is possible. The patient must also be discouraged from causing any mutilation of the tissue. If needed, an Elizabethan collar may be placed around the bird's neck to prevent access to that area.

Many cases require surgery to resolve the prolapse. Parenteral antibiotic, analgesic, and antiinflammatory medications should be considered. Under general anesthesia, the prolapsed tissue may be gently cleaned with a dilute chlorhexidine solution and rinsed with saline. A water-based lubricant may be applied and the cleaned tissue may be removed with a cotton-tipped applicator using gentle inward pressure. Vent sutures may be applied to the mucosa of the vent using 3-0 or 4-0 monofilament sutures.

In general, prognosis for resolution of the prolapse is fair. However, birds may chronically prolapse if the underlying problem is not adequately addressed. Behavioral causes tend to be difficult to pinpoint and treat and may worsen the prognosis. Administration of psychotropic medications is helpful in some situations.[11] Birds in which the cause of prolapse is not determined have a guarded to poor prognosis for recovery.

Oviductal Impaction

Impaction of the oviduct most commonly occurs secondary to dystocia or inflammation. In dystocia, hens with delayed oviposition may continue to ovulate, causing

inflammation and swelling of the reproductive tract. The swelling may become grossly visible as abdominal swelling. Many of these patients may be lethargic, have decreased droppings, and have difficulty breathing due to pressure placed on the surrounding air sacs. Serious concern should also be given to the potential effect of pressure and infectious material on the nearby kidney and sciatic nerves. Continual insult to the kidneys likely results in shock to the patient and eventual death.

Diagnosis of impaction may be based on results of radiography or ultrasonography, although laparoscopy may be helpful. Aspiration of a swollen abdomen may reveal egg yolk material; however, there is a risk of seeding egg contents and other potentially infectious material from the interior of the reproductive tract into the coelomic cavity. After a period of time, the eggs inside an impacted oviduct will likely form adhesions with the mucosal tissue and require surgery to remove either the eggs or the entire reproductive tract in severe situations.[12,18] These patients tend to be moderately to severely ill and the prognosis is guarded. Antiinflammatory and long-term antibiotic medications may help reduce inflammation and infection. Administration of high-dose hormone therapy, such as leuprolide acetate, may prevent the onset of future reproductive activity.

Oviductal or Uterine Rupture

Rupture of the oviduct or uterus is a potential outcome of dystocia, especially when a hen has been struggling to pass an egg for a long period. Necrotic tissue, which is prone to rupture, may develop as a result of adhesions between the egg and reproductive tract. Ruptures may also occur secondary to neoplasia.[4] Administration of hormones such as oxytocin or prostaglandin in the face of adhesions is contraindicated and likely to cause a rupture and possible death of the bird. Clinical signs of rupture may be nonspecific, including lethargy, abdominal swelling, an increased respiratory rate, an elevated heart rate, anorexia, and regurgitation.

Diagnosis is based on ultrasonography or laparoscopy. The prognosis for survival may be guarded to poor. Emergency exploratory surgery, which likely involves a salpingohysterectomy and gentle, copious flushing with a warm balanced electrolyte solution, may provide the best outcome. Care must be taken during flushing to avoid the air sacs so that the bird does not drown. The presence of a large amount of egg contents or other inspissated material in the coelomic cavity increases the likelihood of development of coelomitis and systemic infection and worsens the patient's prognosis. These patients may require an extensive hospital stay, frequent testing of cultures and blood parameters, and improvement in clinical condition before they are considered healthy.

Salpingitis and Metritis

Salpingitis and metritis refer to inflammation or infection of the oviduct and uterus, respectively. Possible causes of salpingitis and metritis include inflammation secondary to dystocia or ruptured eggs, ascending infections, or inflammation and infection from surrounding tissues, such as the liver or air sacs. Clinical signs in mild to moderately affected patients may be subtle and nonspecific and include some of those signs discussed previously, such as difficulty breathing, lethargy, fluffed feathers, or changes in the appearance of the droppings.[6]

Patients with suspected disease may be evaluated based on blood work, radiographs, culture, and laparoscopy. In more serious situations, such as ruptured eggs, exploratory surgery may be needed for proper assessment and treatment of damaged tissue. Broad-spectrum antibiotic and antiinflammatory medications as well as fluid therapy and recovery in a warm incubator may help improve the outcome

in this condition. Any additional treatment, such as oxygen therapy, may be based on the clinical signs observed.

Neoplasia of the Ovary and Oviduct

Neoplasia of the reproductive tract may occur more commonly in the ovary when compared with the oviduct, and some avian species, such as the budgerigar and cockatiel, tend to be more represented than others.[7] Clinical signs include difficulty breathing, fluid in the coelomic cavity, abdominal enlargement, fluffed feathers, lameness, lethargy, and anorexia.[15] In budgerigars, female birds may show a change in the color of the cere in the presence of reproductive tract neoplasia. The types of reproductive neoplasia previously identified included hemangiosarcoma, adenocarcinoma, adenoma, and carcinomatosis.[4,7,19]

Diagnosis of neoplasia may be difficult to obtain with radiographs, because it may be difficult to distinguish normal enlargement of the reproductive tract from neoplastic causes. Other diagnostic tools to consider include ultrasonography, laparoscopy, and histopathology of suspected lesions. Treatment depends on the type and location of the neoplasia and the clinical signs of the patient. In some early tumors of the oviduct, for instance, surgical excision may be curative. Other tumors may be treated with chemotherapy, but the lack of extensive case studies makes it difficult to understand what the tumor response will be. Overall, the prognosis for patients with neoplasia is guarded to poor.

REVIEW OF MALE REPRODUCTIVE ANATOMY

The testes are located on the right and left sides of the coelomic cavity near the caudal border of the respective lungs and the cranial border of the kidneys (**Fig. 3**). The testes, which are circular to oval in shape, are small in the reproductively inactive male and grow to a large size in the reproductively active male.

The outer layer of the testis is covered by a thin tunic. The internal portion of the testis contains thousands of seminiferous tubules. The seminiferous tubules connect to straight tubules where sperm formation occurs. Sperm formation, or spermatogenesis, occurs in 3 steps with the final step resulting in the formation of the spermatozoa. The mature spermatozoa travel from the straight tubules into the rete testis. Although the rete testis is present in some birds, it is not clear whether it is present in all psittacines.

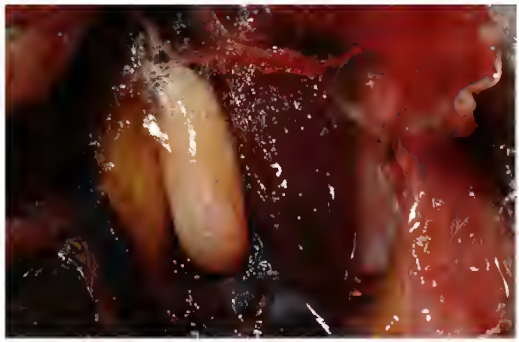

Fig. 3. Left testicle (center) located adjacent to left kidney and right testicle. (*Courtesy of* Dr Kemba Marshall, DVM, Phoenix, AZ, USA.)

Channels in the rete testis, through which sperms travel, normally connect to the epididymis along the medial surface of the testis. The epididymis makes a connection to the efferent ductules and smaller ductules, which eventually open into the very straight epididymal duct. The epididymal duct runs directly into the deferent duct. In the sexually active male chicken, spermatozoa may be found from the epididymal duct to the deferent duct. In general, it takes the spermatozoa about 1 to 4 days to travel from the rete testis to the deferent duct.[1,2]

MALE REPRODUCTIVE DISORDERS

Orchitis

Orchitis can occur from infection and less likely from primary inflammation. Infection may come from a variety of sources including nearby infected organs, an ascending infection, or secondary to a systemic infection. The most commonly cultured bacteria include *Escherichia coli* and *Salmonella* spp.[7] Clinical signs may be vague and nonspecific, although orchitis should be a serious consideration when infertility is suspected. Evaluation of baseline blood work may be the first step toward identification of an infection or other organ changes, but testing for other specific diseases that may affect the testes should not be overlooked. Radiographs may show enlargement of testes; however, normal testicular enlargement may be difficult to distinguish from enlargement due to an infection. Laparoscopy or ultrasonography may also demonstrate gross changes in the appearance of the testes. Culture and histopathology of the affected testicle, culture and cytology of the semen, or culture of the cloaca likely aids the diagnosis.[7,20] Medical treatment should be based on the results of antimicrobial sensitivity testing.

Testicular Neoplasia

Neoplasia of the testicles is commonly diagnosed in male budgerigars. Similar to female budgerigars with neoplasia of the reproductive tract, males may also show changes in the color of the cere. The most dramatic clinical signs may include behavioral changes, such as increased aggressiveness or feminization, and an enlarged coelomic cavity in advanced scenarios. One or both testes may be affected. Although seminomas represent the most commonly diagnosed testicular tumor, Sertoli and interstitial cell tumors have also been diagnosed. Surgical removal of testes, which may be challenging to perform under most circumstances, may be curative. However, severely enlarged tumors tend to be difficult to resect. The prognosis for return to normal testicular function is poor, whereas the prognosis for overall survival is guarded.[7]

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